Community College Under-representation in STEM Research: Back of the Envelope Calculations

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Last updated: November 30, 2022

One might guess that students who have attended community college (CC) are under-represented in US STEM research, but by exactly much? We answer this question to first-order accuracy.

Claim. *Given that a student attended community college before getting a STEM bachelors at a four-year university and subsequently finding employment, she/he is approximately* ***13x less likely*** *to complete a STEM PhD then if they started their education at a four-year institution.*

Discussion

With this claim, we hope to to capture the statistical factor representing the barrier CC students encounter in entering research. Thus, if we were to consider how much less likely is *any* CC student to enter research when compared to a student who started at a 4-year, we would be doing injustice to the question by including students who are neither fit nor interested in research. Hence, only including students who were sufficiently competent to transfer from CC, graduate from a 4-year university, and find employment, we only include students with research potential, better capturing community-college-transfer-specific challenges.

Data

The statistics we use for our calculations are:

1. According to the NSF, in 2019 45.0% of employed STEM bachelor degree holders attended community college. (table 2).
2. According the National Student Clearinghouse Research Center, from STEM PhDs awarded in 2016-2017, 5.7% of them were awarded to students which have attended community college (Figure 3).

Calculation

Define the events:

- P: the event a person has a STEM PhD.
- B: the event a person has a STEM bachelors *and* is employed.
- C: the event a person has attended community college.

In terms of the events, taking the probability over US permanent residents and attendees of US colleges, we are interested in finding:

$$\frac{\Pr(P|B \wedge \neg C)}{\Pr(P|B \wedge C)}$$

simplifying using basic probability laws:

$$\frac{\Pr(P|B \wedge \neg C)}{\Pr(P|B \wedge C)} = \frac{\Pr(P \wedge \neg C)\Pr(B \wedge C)}{\Pr(B \wedge \neg C)\Pr(P \wedge C)} = \frac{\Pr(\neg C|P)\Pr(P)\Pr(C|B)\Pr(B)}{\Pr(\neg C|B)\Pr(B)\Pr(C|P)\Pr(P)} \approx \frac{(1-.057)(.45)}{(.55)(.057)} \approx 13.54 \approx 13$$

Note we assume all PhDs have a bachelors. That is, $\Pr(B|P) = 1$.